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Designing and Implementing Meaningful Field-Based Experiences for Mathematics Methods Courses: A Framework and Program Description

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Performance-based approaches to learning and assessment are consistent with goals for standards-based instruction and show promise as a vehicle for teacher change. Performance assessment involves students participating in an extended, worthwhile mathematical task while teachers facilitate and assess their learning. We designed and implemented a project in an elementary mathematics methods course in which preservice teachers developed performance assessment tasks and then administered these tasks in K-8 classrooms. We present our guiding framework for this project, the project design, and the teaching and learning experiences for project leaders and preservice teachers. Recommendations and reflections are included for others intending to implement similar projects.

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The current reform movement in mathematics education is based on national and state standards for students' learning (e.g., National Council of Teachers of Mathematics [NCTM], 1989, 2000) and on the perspective that students learn by actively constructing their own knowledge and understandings. Within this context, educators and researchers have identified two different but complementary needs for preservice teacher education in mathematics. First, preservice teachers need to learn to use performance assessment strategies to effectively meet and assess standards-based learning objectives. Second, preservice teacher learning should be situated in classroom practice to facilitate their pedagogical knowledge constructions and their enculturation into a community of practice. Below we discuss each of these needs for preservice teacher education, and then we describe the program we have developed to meet these needs.

Call for New Forms of Assessment

Following the release of NCTM's Curriculum and Evaluation Standards (1989), many states and local school districts have developed standards for students' learning in mathematics. Included in these standards and in NCTM's updated standards, the Principles and Standards for School Mathematics (PSSM) (NCTM, 2000), are greater emphases on the processes of doing mathematics (e.g., problem solving and reasoning) and on communicating thinking and solution strategies (NCTM, 1989, 2000).

Also included in these standards is a call for new forms of assessment. Traditional paper and pencil classroom tests and standardized multiple-choice tests focused on recall of facts and basic procedures do not effectively measure what is valued for standards-based learning (Darling-Hammond & Falk, 1997; Shepard, 2000). While traditional measurement approaches to assessment were once aligned with the instructional practices of a century past, these approaches are not consistent with current teaching and learning goals from a social constructivist perspective (Shepard, 2000). This incongruity has resulted in an emerging paradigm for assessment that involves teachers' assessment of students' understandings and students' self-assessments as part of the social process of knowledge construction (Shepard, 2000). Educators and researchers argue that to align assessment with standards-based learning, the following changes are needed: (a) the form and content of assessments must represent higher order thinking, reasoning, communication, problem solving skills, as well as a conceptual understanding of subject matter; and (b) the focus of assessment policy needs to shift to using assessment for learning (Borko, Mayfield, Marion,

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Flexer, & Cumbro, 1997; Darling-Hammond & Falk, 1997; Shepard, 2000).

Consistent with these views, in mathematics education the PSSM state that the primary purpose of assessment should be to "support the learning of important mathematics and furnish useful information to both teachers and students…. Assessment should be more than merely a test at the end of instruction to see how students perform under special conditions" (NCTM, 2000, p. 22). To achieve this goal, the Standards call for embedding assessment in instruction, rather than keeping assessment as separate from learning (NCTM, 1995, 2000). Indeed, this call is supported by research that indicates use of formative assessments, the continual assessment of learning throughout an instructional sequence, in instruction enhances student learning (Black & Wiliam, 1998).

Performance Assessment to Improve Teaching and Learning

As a result of this call, attention has been directed to more authentic forms of assessment, including *performance assessment* (PA). Indeed, well-designed PA tasks can assess student understanding as well as teach concepts as a formative assessment (Darling-Hammond & Falk, 1997; Shepard, 2000). While a single definition for PA does not exist, Stenmark's (1991) definition for PA in mathematics education seems to capture the important aspects of this approach. Stenmark states, "A performance assessment in mathematics involves presenting students with a mathematical task, project, or investigation, then observing, interviewing, and looking at their products to assess what they actually know and can do" (1991, p. 13).

Educators and researchers argue that the advantages of classroom based performance assessment are that they provide the opportunity to:

1. Examine the process as well as the product and represent a full range of learning outcomes by assessing students' writing, products, and behavior (Danielson, 1997; Shepard, Flexer, Hiebert, Marion, Mayfield, & Weston, 1996).
2. Situate tasks in authentic, worthwhile, and/or real-world contexts (Stenmark, 1991).
3. Preserve the complexity of content knowledge and skills (Shepard et al., 1996).
4. Assess higher-order thinking skills and deeper understandings (Firestone, Mayrowtz, & Fairman, 1998).
5. Embed assessment in instruction, rather than separating it from learning (Stenmark, 1991).
6. Apply criterion referenced assessment approaches based on important learning outcomes, rather than norm-referenced (Stenmark, 1991).

Early research indicated that using performance assessment in instruction can improve student learning and teaching. Fuchs, Fuchs, Karns, Hamlett, and Katzaroff (1999) studied the effects of classroom based performance-assessment-driven instruction. They found that students in PA-driven instruction classes demonstrated stronger problem solving skills than comparison groups that were not PA-driven. Shepard et al. (1996) found that the teachers involved in their study were beginning to show substantial changes in practice. The changes included: greater use of manipulatives; increased emphasis on the teaching and learning of problem solving strategies; and increased class time and focus on written explanations in mathematics. Similarly, in Borko et al.'s (1997) study of a professional development program on using performance assessment strategies in mathematics instruction, they found that their teachers changed their instructional practices to incorporate more problem solving activities, student explanations of strategies as a central component of their programs, and scoring rubrics for assessing students' solutions of open-ended tasks. These changes all represent a shift towards standards-based instruction. Given that these studies indicated that work with PA served as a vehicle for change for inservice teachers, we pursued a program for preservice teachers that focused on PA as a means of building their understanding of standards-based practices.

While it is possible to derive many instructional benefits from PA strategies, it is not clear that teachers can easily or quickly learn to implement these strategies in practice. Firestone, Mayrowetz, & Fairman (1998) studied teachers where state testing programs included PA tasks, and therefore teachers felt compelled to use PA in instruction, however, little change in instructional strategies resulted. Firestone, Mayrowetz, & Fairman identified two major barriers to change: a lack of the sophisticated content knowledge required in implementing PA approaches, and a lack of rich tasks and problems in curricular materials to support this approach to instruction. Firestone, Mayrowetz, & Fairman concluded that to effectively implement performance assessment and thereby realize the potential for improved student learning, teachers needed substantive training opportunities (not just new policies requiring new assessment approaches) and new curricular materials that are aligned with

performance assessment strategies and a standards-based vision for teaching and learning.

In accordance with Firestone, Mayrowetz, and Fairman's (1998) research, Borko et al. (1997) found that substantive and sustained professional development is needed for teachers to effectively use and realize the benefits for PA approaches. Their research also indicated that time was a major obstacle to implementing PA approaches. In particular, time served as a barrier in planning for the implementation of new strategies; applying more complex scoring rubrics in assessment; administering the assessment tasks; recording observations of students' working and thinking as part of the assessment; and interviewing students before, during, and after the assessment. For successful change to occur, teachers need time to implement new assessment approaches.

Recognizing the value of PA and the complexity of using these strategies, we decided to make PA a focus of our mathematics methods course. This decision was part of our effort to prepare our preservice teachers from the beginning of their careers to use these approaches and to implement standards-based teaching and learning in their own instructional practice. While we view performance assessment as one form of alternative assessments (cf., Stenmark, 1991), it allows the opportunity for preservice teachers to implement other forms of alternative assessment (e.g., brief interviews with students and systematically observing students) while students perform a task. Additionally, the nature of performance assessment (focusing on the process and product of doing mathematics), pushes preservice teachers to think deeply about how students think about and do mathematics. Performance assessment also provides an approach for preservice teachers to use in which assessment is part of instruction, a primary focus of the PSSM. That is, tasks facilitate students' learning of content and processes through meaningful problems while teachers assess their work and products. Moreover, as is described throughout this paper, the process of designing and implementing a performance assessment task provided us, as teacher educators, the opportunity to assess the performance of the preservice teachers; consequently the preservice teachers experienced performance assessment as students while they designed and conducted performance assessment with their students.

Situated and Constructivist Perspectives on Teacher Learning

With the goal of developing preservice teachers' abilities to implement PA in their classrooms, we considered a second need identified in teacher education literature: a need to situate preservice teacher learning in classroom practice. Borko et al (1997) emphasized the importance of this approach for professional growth. They found that a key component of their program was their teachers' ability to experiment with and implement the ideas of the professional development workshops in their own classroom practice and then to reflect on these efforts in follow-up workshops.

This finding is consistent with the perspective of teacher learning put forth by Putnam and Borko (2000). They argue that for teachers to construct new knowledge about their practice the learning needs to be situated in authentic contexts. First, learning needs to be situated in authentic activities in classrooms to support transfer to practice. For preservice teachers, a combination of university learning for theoretical foundations and school-based learning for a situated perspective is needed (Putnam & Borko, 2000). Second, preservice and inservice teachers should participate in discourse communities as part of learning and enculturation in the profession. In particular, preservice teachers need to learn about and contribute to a community's way of thinking (Putnam & Borko, 2000). This process of enculturation is especially important to future teachers of mathematics because many come to their education program with limited views of teaching, learning, and doing mathematics (Roth McDuffie, McGinnis, & Graeber, 2000).

Putnam and Borko (2000) recognize that implementing this perspective in teacher preparation programs can be problematic. While we want to place preservice teachers in schools to experience the activities of teaching as part of their learning, K-12 placement classrooms may not embody the kind of teaching and learning advocated in university classrooms and/or these kinds of classrooms may not be available. Moreover, the pull of traditional school culture is strong, and these traditions make it difficult for student teachers to implement different approaches and views (Putnam & Borko, 2000).

Smith (2001) discusses specific approaches for situating teachers' learning in practice based on a synthesis of the literature. We incorporated two of the approaches she recommends: using "samples of authentic practice" (p. 9), and designing our project around "the cycle of teachers work" (p. 10). The first approach involved selecting an example of a mathematical task with a set of carefully chosen student responses. Teachers complete the task and engage in doing mathematics as learners. Next,

teachers analyze the task and a range of students' responses, examining understandings, approaches, and misconceptions in students' thinking and work. The second approach is intended to mirror the nature and cycle of teachers' work. This cycle begins with planning for instruction by targeting learning goals, considering students' prior knowledge, and selecting and/or designing experiences that will promote students' construction of knowledge and understandings. The cycle continues as teachers enact the plan, making adjustments in the plan and instructional decisions to meet students' needs while formally and informally assessing students' learning. Teachers complete the cycle as they reflect on the teaching and learning experience, and use their reflections to guide future instruction. In the next section we describe how these ideas were incorporated in our program.

Program Description

We first implemented our PA program in an undergraduate mathematics methods course at Washington State University Tri-Cities in Spring 2000 and have continued the program in 2001 and 2002. This description focuses on the initial implementation. While the program has changed slightly each year with changes in university faculty, most of the core elements have remained the same, and the revisions and adjustments made over the two years will be discussed at the end of the article. This methods course focused on mathematics teaching and learning at the K-8 level. The PA program was included as part of a one-semester mathematics methods course that met for three hours, once each week of the semester. Twenty-two preservice teachers were enrolled in the methods course, with 18 being between the ages of 20 and 24 and the remaining 4 being second-career students. The PA program aimed to provide a learning experience with both a university component to build theoretical foundations and a field-based component to situate learning in the authentic context of the school classroom, as recommended by Putnam and Borko (2000) and Smith (2001). The primary goals for preservice teacher learning in this program were:

1. To develop skills and habits of mind for assessing and diagnosing students' mathematical thinking, skills, understandings, and lack of understandings;
2. To understand issues of and strategies for implementing classroom-based performance assessment;
3. To have a meaningful field-based experience including an opportunity to collaborate with expert inservice teachers and work with students.

A brief timeline of the PA program is provided in Table 1, and a description of these activities is provided below.

Planning the Program

A collaborative team planned the performance assessment program prior to the beginning of the semester, and continued to meet and adjust the program as needed during the semester. The planning team was composed of a mathematics educator (first author), a science educator (second author), four middle school mathematics teachers, a middle school social studies teacher (for inter-disciplinary

Table 1
Performance Assessment Program Timeline.

Week of Semester	Activity
3	Introductory PA workshop conducted during regular class meeting (3 hours).
3-5	Preservice teachers began to research PA task topics and plan task outside of class.
5	Preservice teachers submitted their PA task planning guides and their journal article reviews on their selected PA task topics.
6	Collaborative team met to match mentors with preservice-teacher-groups.
7	Mentors met with their assigned preservice-teacher-groups during class to provide advice and feedback on preservice teachers' initial plans for their PA tasks (1 hour).
8	Preservice teachers submitted first draft of PA tasks to their mathematics methods professor (first author) and to their mentor teachers.
9	Preservice teachers received written feedback from their mathematics methods professor (first author) and from their mentor teachers.
9-12	Preservice teachers revised their tasks and field-test tasks in their mentor teachers' class.
13	Preservice teachers submitted their report of their PA tasks
14	Preservice teachers submitted a follow-up lesson plan based on PA findings.

connections), and a secondary program administrator from a Washington State Educational Service District. The middle school teachers were recognized regionally as teacher-leaders for their expertise in performance assessment strategies, and more generally, for implementing standards-based approaches to teaching and learning. The team worked together to develop the preservice teachers' understanding of PA, match preservice teachers to mentors, and to support the preservice teachers in their PA task design and implementation. These efforts were aimed at ensuring that our program was providing for meaningful interaction between preservice teachers and inservice teachers, as called for by Putnam and Borko (2000) (Goal 3), and thereby facilitating the preservice teachers' growth in understanding students' thinking and learning (Goal 1) and in implementing the PA strategies (Goal 2). It should be noted that a practicum field component was not built into the semester for the preservice teachers, and thus this field experience was initiated and arranged entirely by the planning team.

Introductory Assessment Workshop

This workshop was conducted during the regular methods class meeting time for a three hour period. The collaborative team planned and facilitated the workshop with team members leading different parts of the workshop. It was conducted to address our second goal by briefly discussing general assessment issues, providing an overview of the standards-based assessment program in Washington State (e.g., see Washington Commission on Student Learning, 1998), and introducing the preservice teachers to performance assessment issues and strategies.

To introduce the preservice teachers to performance assessment, we asked them to work in groups on a sample performance assessment task that was written and field-tested as part of an assessment program in Washington State. The task required the preservice teachers to design a cereal box that would reduce the amount of cardboard needed and still maintain a specific volume, and then to write a letter to the cereal company describing and defending their design. While we only provided approximately twenty minutes for the preservice teachers to work on the task, they had enough time to identify key issues of the task and key components of task-design. Next, we discussed some of the features and purposes of the task. Consistent with our framing of the features and purposes of PA, we examined the authentic context of the tasks, the open-ended questions involved, the descriptive and persuasive writing components, the multiple entry points and various solution methods possible in performing the task, and opportunities for assessing higher order thinking. After this discussion, we gave the groups scoring rubrics and samples of ninth grade students' work on the task at various performance levels. Using the scoring rubrics, the groups assigned scores to their sample students' work. Following this group work, we discussed the scoring process, the rubrics, and the task as a class. This component was designed to attend further to our first goal regarding students' thinking and understandings by exploring a sample of "authentic practice" (Smith, 2001, p. 9) in that the task selected was used in local classrooms and students' work (in their own hand) on this task was analyzed for understandings and approaches.

Next, we worked to formalize their knowledge of performance assessment (Goal 2) by discussing defining characteristics of performance assessment, as well as advantages and limitations. Additionally, a middle grades language arts teacher-leader facilitated a brief discussion of types of writing used in performance assessment (e.g., descriptive, expository, and persuasive). We concluded the workshop with an introduction of the planning guide (described in detail below) and provided a few minutes for generating ideas for the preservice teachers' PA projects.

Researching Topics and Generating a Plan for the PA Task

The preservice teachers formed groups of two to three to collaborate on the PA task project. Each group chose a mathematics topic for the focus of their task. The groups were restricted to middle school mathematics topics because all of the mentor teachers selected were teaching at the middle school level. This restriction was due to the planning team's decision to select mentor teachers with experience in PA, and we had difficulties finding such teachers at the elementary level. Once the topic was chosen, each group member found a minimum of two journal articles discussing teaching and/or learning issues for that topic. The preservice teachers submitted a brief summary of each of their articles and an explanation on how the information in the article contributed to their thinking and plans for their PA project. The purpose of this component of the project was to lay a foundation for understanding students' thinking and learning (Goal 2) by ensuring that the preservice teachers had some awareness of the pedagogical issues surrounding their topic as reported in mathematics education literature.

Additionally, each group used a planning guide to outline major features of their task and keep them focused on goals and purposes of performance assessment (versus other types of projects or assessments). To show a clear and mathematically important purpose for the task, the preservice teachers described the concepts and processes targeted for assessment. To demonstrate how the task would engage learners, the preservice teachers explained the task's authentic and/or worthwhile context, the role the learner would play in performing the task (other than a student doing math for a class), and the audience for the product (other than a teacher grading a project). To ensure alignment with selected goals and define criteria for quality performances, the preservice teachers created a table showing connections among learning standards, task products and/or performances, and criteria for measuring whether learning goals had been met. Because the Washington State Essential Academic Learning Requirements (EALRs; Washington Commission on Student Learning, 1998) were emphasized in this course, our students identified appropriate EALRs for their task. However, PSSM could have been used in lieu of the EALRs. Regardless of which standards were applied, this component focused preservice teachers' thinking on the notion that assessments need to be aligned with important instructional goals (part of Goal 2).

From this point, the groups continued developing their tasks outside of class time. While many groups created original tasks, the preservice teachers were permitted to use outside resources (e.g., activity books, journal articles, their Van de Walle (1998) textbook, etc.) in developing their tasks. We did not require that their work be entirely original because we wanted the process to mirror that of teachers' planning (cf., Smith's (2001) recommendations), and teachers often draw from existing resources, rather than write their own tasks. Even in the cases where a problem, activity, or task was used from an outside source, significant work was required to develop the problem into a performance assessment task and meet the assignment requirements.

Collaboration Between Mentors and Preservice Teachers

Using the information provided in the preservice teachers' planning guides (i.e., grade level and topic targeted), we matched each preservice-teacher-group to one of four mentor teachers. Each mentor teacher was responsible for advising two groups of preservice teachers.

After the mentor teachers had been assigned to groups of preservice teachers, the mentors attended one hour of a methods class. The preservice teachers brought their planning guides and drafts of their PA tasks to this meeting. During this hour, the mentor teachers met with each of their groups to discuss their ideas and plans for implementing the PA tasks. We provided the mentors and preservice teachers with specific discussion prompts including individual students' learning needs, mentor's typical teaching practices, and classroom norms. The members of the planning team circulated to assist groups in designing their tasks and keep groups focused on objectives. These meetings were planned to address our third goal of facilitating meaningful collaboration with teachers, and consequently, more authentically engage in the planning phase of teachers' work as recommended by Smith (2001).

Submitting the First Draft and Field-Testing the PA Task

Continuing on the theme of experiencing the cycle of teachers' work (Smith, 2001), in the eighth week of the semester, the groups submitted their first drafts of their PA tasks to their mathematics methods professor and to their mentor teacher. This draft included a brief overview of the task, a table showing alignment between task items and the EALRs (revised and developed further from their initial plans), instructions for administering the task and a list of materials needed, the task as it would be administered to students, and rubrics for scoring the task. Within a week, both parties provided written feedback and comments for the groups to consider before administering their tasks to middle school students.

As part of our third goal of situating the project in the schools, each group arranged a time to field-test their PA tasks in their mentor's class. The tasks were designed to be completed in two to three 50-minute class periods. Each mentor teacher decided with his or her groups who would facilitate the task. In some cases the mentor teacher was the primary facilitator and in other cases the groups facilitated the task administration. However, in all cases, the preservice teachers observed throughout the task administration, talked with students, and in some cases, interviewed students about their thinking, and recorded notes on the process.

Analyzing Results and Reporting on the PA Task

Following the field-test, the preservice-teacher-groups scored the students' work and analyzed selected

students' work in greater depth for the purpose of understanding students' thinking and learning (Goal 1). Finally, they prepared a written report of their analysis of students' work and their reflections on the performance assessment process and project to examine the strengths and limitations of PA, as part of Goal 3.

Writing a Follow-up Lesson Plan

To help preservice teachers understand the teaching and learning cycle of using assessment to inform instruction (Goal 2), the preservice teachers were required to write a lesson plan based on their findings in the performance assessment task administration. In some cases the lesson plans were on a topic closely related to their PA task topic, and in other cases the preservice teachers identified weaknesses in underlying skills and thinking through the PA, and correspondingly chose topics that were less obviously related to their PA topic. As part of the lesson plan, the preservice teachers explained how the lesson was motivated by their findings in the PA task administration.

Providing Release Time and Compensation for the Mentor Teachers

Throughout the semester inservice teachers played a key role in the project. They attended two class meetings during the school day, an evening meeting, and provided written comments on the first draft of each of their two groups tasks. For this project, we were able to provide substitute teachers to release the mentor teachers from their teaching responsibilities on the days they attended the methods class. Additionally, the mentor teachers were compensated for their time during the evening meeting and for their reading of the projects. This funding was available through the Washington State Educational Service District. We believe that this support enhanced the extent to which the mentor teachers were committed to the program, and contributed to our efforts to meet Goal 3, creating a meaningful collaboration with inservice teachers.

Reflections on the PA Program

We found that all of our goals were achieved in that students began to develop understanding in our areas of focus (Goals 1 and 2) through careful facilitation of field-based experiences (Goal 3), and indeed we experienced some unanticipated benefits. However, these achievements were not gained without some significant challenges. In the process of implementing this project, we also recognized areas to preserve and to change, and have made changes in our program in semesters following the initial implementation. These reflections and changes are described below.

Benefits of the Program

Our first goal of developing skills in assessing and diagnosing student thinking was met in that the preservice teachers provided substantive analysis and interpretations of students' thinking, understanding, and lack of understanding in their reports on their PA tasks and follow-up lesson plans. For example, in Karen's (all names used are pseudonyms) final report, she reflected on her students' work and remarked,

> Although [the group's] worksheets were not… complete, … [they] added new insights to the final group discussion by introducing conjectures to the problem…they exhibited a higher level of reasoning. … They argued various points and brought up ideas that even [we] had not considered. Their inferences and thought processes led others to question their own conclusions.

These comments demonstrate how the preservice teachers were observing and analyzing their students' work on a deeper level than simply looking for correct answers.

In regard to our second and third goals, we believe that our preservice teachers cannot truly come to understand performance assessment, its complexities, its benefits for understanding students' thinking and learning, and its benefits for informing teaching without experiencing the process of designing and implementing performance assessment tasks first hand. At the end of the semester, the preservice teachers demonstrated their understandings of PA in their reports and comments. Sarah's explanation of PA was typical of preservice teachers' understandings when she described PA as:

> A task which has a real world problem to assess students' understanding of a topic. …[It can be used] to assess what someone already knows, like at the beginning [of a unit], … or at the end to evaluate what they have learned and how your teaching has helped them to understand that concept.

While we intended for the preservice teachers to consider worthwhile or meaningful contexts, not just "real world," it was clear that Sarah understood the primary purposes and approaches of PA.

Our experience in this project and their work in designing and implementing PA tasks suggest that the preservice teachers meaningfully constructed ideas as to what constitutes performance assessment. For

example, one student designed a PA task entitled, "City Park" in which middle school students worked as landscape architects (the role) to design a park with playground equipment and a sprinkler system (the context). In this task the students had to construct a budget, calculate the area of their design, and satisfy various design criteria established by the city council, represent their design visually with a scale, and write a letter persuading the city council (the audience) that their design proposal should be accepted. This task exemplifies how the preservice teachers were able to incorporate key elements of performance assessment in tasks that involve several important mathematical concepts and processes.

Perhaps an even greater benefit was that the preservice teachers began to understand assessment as a formative process, rather than merely a grade in the grade book. They began to generalize the ideas from performance assessment to understand and be interested in other forms of authentic and alternative assessment such as interviewing and observational record keeping. Dora exemplified these understandings for assessing in multiple ways when she said,

> [This type of assessment] engages the students in real-world problems, capitalizes on their prior knowledge, requires them to think critically, and allows the teacher to assess by observation.… As I circulated throughout the room listening to students, making mental notes about what was going well and what changes need to be made, it was obvious that the students were using their prior knowledge.

Moreover, as is evident in the earlier example of the "City Park" task, designing and administering a performance assessment task also seemed to help the preservice teachers construct a more sophisticated notion of problem solving in mathematics and more fully understand what is meant by an open-ended task, consistent with Shepard et al.'s (1996) findings for inservice teachers. Focusing on our third goal specifically, the situated nature of the project (i.e., designing an open-ended task for actual students, working with an experienced teacher, and administering the task in a school classroom) seemed to be the most important factor in bringing about the preservice teachers' interest in the project and learning from the project. Robert's reflections represented what we heard from virtually all of the preservice teachers in their final reports and/or course evaluations. He stated, "The project was an excellent opportunity to work with an actual math class. It gave me a good picture of what the students know and how they can learn." Thus, we found that following Borko et al.'s (1997), Putnam and Borko's (2000), and Smith's (2001) recommendations for situating tasks in actual classrooms were an important part of our program.

Additionally, we observed professional growth opportunities for the mentor teachers. All of the mentor teachers commented that they learned more about performance assessment strategies and gained ideas for their own teaching through their involvement in the project. For instance, one mentor stated, "[Working with a preservice teacher in this program] affirmed my strong belief in observable assessment for young learners. It gave me a chance to teach someone else techniques I have developed."

Challenges of the Program

Similar to the Borko et al. (1997) finding, time emerged as a primary challenge in implementing our project. Time was a challenge in the form of demands on the methods professor, mentor teachers, preservice teachers, and the mentor teachers' class time. For the methods professor (first author), this project certainly demanded more time in planning and assessing. As a new endeavor, more time was required to plan the project, especially in regard to the time required to meet with the project team. While collaboration often produces better results for learning, it seems to take more time than working independently in teaching. Additionally, assessing and providing feedback on the preservice teachers' work throughout the project required more time than is typically spent assessing written work in a methods class.

As described earlier, the mentor teachers in this project were provided release time and compensation for their significant time committed to the project. Certainly, we preferred to offer support to inservice teachers who took on this responsibility. However, this funding was not available to us after the initial implementation and we have found that the program is manageable without funding.

The preservice teachers also experienced significant time demands. While most preservice teachers commented (either orally or in course evaluations) that the project was worth the effort, they all seemed to feel that the workload for the class was heavier than other classes due to the PA project. This challenge is consistent with Borko et al.'s (1997) finding for the increased planning time required in using PA. In addition to the PA project, the preservice teachers had several additional course assignments and requirements. In semesters following the initial implementation, we reduced other assignments

recognizing the time this project requires and the multiple purposes it serves (i.e., we found that writing the PA assignment could serve in lieu of a lesson plan).

In addition to challenges with the magnitude of the project, some of the preservice teachers had difficulty arranging for administering their tasks in classrooms. This mathematics methods course did not have a field experience as part of the course. As such, time to be in the schools was not allocated in their schedules. Moreover, given that the timing had to meet the needs of the mentor teacher, scheduling was not simply a matter of finding time in the preservice teachers' schedules. In some cases, not all group members were able to be present for each day of the task; however, everyone managed to be present for some part of it. Our teacher education program soon will include a practicum experience as part of a methods block scheduling structure. As this practicum is instituted, we are hopeful that some of the logistical issues, particularly the scheduling problems associated with the field component will be mitigated.

Most tasks required more time than anticipated by preservice and mentor teachers, and correspondingly either the task was modified or the mentor teacher allowed the preservice teachers to use more than three days of class time. Consistent with Borko et al.'s (1997) findings, PA requires a substantial investment of class time, and it is not easy to predict how long the students will need to complete their work.

In addition to time demands, we faced a challenge identified by other researchers (Putnam & Borko, 2000; Sykes & Byrd, 1992): finding appropriate mentor teachers. We wanted the mentor teachers to have expertise in PA and to be able to provide the needed support to the preservice teachers. We had limited success in finding these candidates. The teachers involved with our planning team were well qualified and successful mentors; however, the other two teachers that were recruited were not as informed about PA strategies and did not seem to be as committed to supporting our preservice teachers. The preservice teacher groups working with these teachers commented that they provided limited support in designing and implementing the task, and it seemed that the mentors did not feel qualified to discuss PA strategies. While we initially perceived that all of the mentor teachers were interested in the project and had the necessary expertise to provide support to the preservice teachers, these teachers needed more experience with these approaches before they could adequately advice our preservice teachers.

Additionally, two groups of preservice teachers mentioned that they had difficulty communicating with their mentor teachers (e.g., emails and phone messages were not returned, minimal written comments on their PA task draft was provided, etc.), and these groups perceived that they did not receive the same level of support as their classmates. One mentor teacher had some health concerns during the semester, and the other teacher seemed to have pressing issues in her teaching that resulted in less time being devoted to the project. While these cases could be called exceptions, we believe these situations are to be expected when asking inservice teachers to take on another responsibility. Thus, accommodations for unexpected situations with mentor teachers should be expected and planned for as much as possible.

We have recruited more mentor teachers through referrals from participating teachers, and are adding teachers who have been involved in summer workshops and/or graduate courses focusing on assessment offered at our university. Even as we have expanded our pool of mentors, challenges remain. As with any field-based work, we have found that we need to be flexible with project due dates while still trying to structure the program through the three-part assignment (planning guide, task draft, final report) to keep the preservice teachers progressing during the semester.

Features of the PA Program to be Preserved

In attempting a program for the first time, we found that we made several decisions along the way, some that were well conceived and others that were quick solutions. In this section we reflect on some of the key decisions that worked well for us. First, we were asked whether the mentor teacher or the preservice-teacher-group should facilitate the task. Given that the preservice teachers did not necessarily have any experience in the mentor teachers' classes prior to administering the PA task, we allowed the mentors and the preservice teachers to decide on the preservice teachers' level of involvement in facilitating the task. The preservice teachers had various levels of classroom experience, and leaving this decision to the mentor-preservice teacher groups enabled everyone to make decisions within individual contexts. The primary purpose of the field-based component of this project was not to provide a student teaching experience as much as it was for preservice teachers to learn about performance assessment in a situated context of the middle school classroom. For preservice teachers and mentors that were not comfortable with

the preservice teachers facilitating the tasks, this flexibility seemed to enhance the preservice teachers' abilities to focus on performance assessment and diagnose students' thinking and learning more than it might have if they had the added stress of teaching during the task.

In regard to the assignments of the project, two non-field-based components were important to preservice teacher learning: the initial research of the mathematics topic and the follow-up lesson plan. By requiring that the preservice teachers find journal articles examining the teaching and learning issues surrounding their topic, the preservice teachers gained in-depth expertise on the theoretical foundations of their topic beyond what is normally discussed in class. While this type of assignment has been a part of our methods courses in the past, connecting it to the situated context of the PA project gave it more meaning for the preservice teachers. Additionally, the project provided some assurance that they were better informed about the pedagogical issues surrounding their topic as they designed tasks, and many preservice teachers commented that the project helped them anticipate and/or avoid potential problems in the classroom. Likewise, the follow-up lesson plan helped the preservice teachers to see what a classroom teacher would do with the information gained from the assessment. We found the preservice teachers to be more invested in these lesson plans than in others required for the course because they had their classroom experience and real students as their referent when they designed them.

Features of the PA Program to be Changed or Added

First, in attempting to find qualified mentor teachers, we were able only to find middle school teachers who seemed to have appropriate experience. Correspondingly, we limited our preservice teachers to writing PA tasks for middle school mathematics. Some of the preservice teachers were unhappy with this limitation because they intended to teach at the elementary level and were not interested in the middle school level. For these preservice teachers, the PA project seemed less authentic because it was not situated in the grades in which they intended to teach. Another problem was that all of the mentor teachers were not selected prior to the start of the semester. It may not be a coincidence that the two less committed mentors were called upon part way into the semester and therefore were not included in early planning efforts. We believe that we would have been more successful if we had involved all of the mentors in the PA project throughout the entire semester. Since this first implementation, we have been more successful in assembling a cadre of mentor teachers at all grade levels to draw from each semester and to better match the PA project requirements with our preservice teachers' interests. However, we continue to struggle with having all of the mentors selected prior to the start of the semester. Some teachers and school districts are reluctant to commit to the program in advance, especially for the fall semester when schools are still organizing their own teaching assignments.

In addition to more mentors, we realize that our preservice teachers need more opportunities to interact with their mentors. For example, a final meeting between preservice teachers and mentor teachers would provide an opportunity for preservice teachers to review their analyses and report on the students' performances. This meeting would provide the mentor teachers with a new perspective on their students' thinking, learning, abilities, and skills. It also might serve to help the mentor teachers improve their mentoring skills by more carefully examining the products of the preservice teachers' work. Moreover, this meeting would provide preservice teachers with feedback on their analyses based on the teachers' knowledge of their students, and this feedback and perspective is not possible from their methods professor. However, logistics with scheduling and the need for substitutes have impeded these plans.

Next Steps

We are continuing to implement our PA program in mathematics methods courses. Our current efforts include offering this PA program in both the mathematics and the science methods course with the students using PA to make connections between the disciplines. The benefits we have experienced compel us to continue to develop this program. A study is underway to empirically investigate the effects of our program on our preservice teachers' learning of PA, and more generally, the teaching and learning of mathematics

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